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Session LC04 - Magnetic Nanostructures V: Heussler Alloys and Half-Metallic Ferromagnets.
ORAL session, Tuesday afternoon, March 23
Room 368W, GWCC

[LC04.05] Non-equilibrium Superconductivity and Magnetic Pair Breaking in Perovskite Half-Metallic Ferromagnet-Insulator-Superconductor (F-I-S) Heterostructures

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The effect of spin-polarized quasiparticle currents on the critical current density (J_c) of cuprate superconductors is studied in perovskite F-I-S heterostructures as a function of insulator thickness and of underlying magnetic materials. A pulsed current technique is employed to minimize extraneous Joule heating on the superconductor. At temperatures near T_c , F-I-S samples with insulator thicknesses $\leq 2\text{nm}$ show precipitous decrease in J_c as current injection (I_m) is increased. In contrast, J_c in a controlled sample with a substituted non-magnetic material (N-I-S) exhibit no dependence on I_m . Similarly, a F-I-S sample with a 10nm insulating barrier also show little J_c effect versus I_m . At low temperatures with $I_m=0$, significant suppression of J_c is observed only in the thin barrier F-I-S samples, although T_c and the normal-state resistivity of all samples are comparable. These phenomena can be attributed to the Cooper pair breaking induced by externally-injected and internally-reflected spin-polarized quasiparticle currents. We estimate an order of magnitude range for the spin diffusion length of 100nm to 100 μm .

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